



UNIVERSITÀ DEGLI STUDI DI PALERMO

DEPARTMENT	Ingegneria
ACADEMIC YEAR	2020/2021
MASTER'S DEGREE (MSC)	ENGINEERING AND INNOVATIVE TECHNOLOGIES FOR THE ENVIRONMENT
SUBJECT	WASTE MANAGEMENT
TYPE OF EDUCATIONAL ACTIVITY	B
AMBIT	50372-Ingegneria per l'ambiente e territorio
CODE	18108
SCIENTIFIC SECTOR(S)	ICAR/03
HEAD PROFESSOR(S)	VIVIANI GASPARE Professore a contratto in Univ. di PALERMO quiescenza
OTHER PROFESSOR(S)	
CREDITS	9
INDIVIDUAL STUDY (Hrs)	144
COURSE ACTIVITY (Hrs)	81
PROPAEDEUTICAL SUBJECTS	
MUTUALIZATION	
YEAR	2
TERM (SEMESTER)	1° semester
ATTENDANCE	Not mandatory
EVALUATION	Out of 30
TEACHER OFFICE HOURS	VIVIANI GASPARE Monday 9:00 11:00 proprio studio (stanza n.2031, ed.8 2° piano) del Dipartimento di Ingegneria Tuesday 9:00 11:00 proprio studio (stanza n.2031, ed.8 2° piano) del Dipartimento di Ingegneria Wednesday 9:00 11:00 proprio studio (stanza n.2031, ed.8 2° piano) del Dipartimento di Ingegneria Thursday 9:00 11:00 proprio studio (stanza n.2031, ed.8 2° piano) del Dipartimento di Ingegneria Friday 9:00 11:00 proprio studio (stanza n.2031, ed.8 2° piano) del Dipartimento di Ingegneria

PREREQUISITES	Basic knowledge of sanitary and environmental engineering, chemistry and hydraulics, allowing to understand the principles and processes analyzed in the course.
LEARNING OUTCOMES	<p>Knowledge and understanding The student at the end of the course will acquire knowledge on criteria and methods for waste definition, classification and characterization; methods for collection, transport; systems for waste treatment, recovery and disposal; planning of waste management systems.</p> <p>Applying knowledge and understanding The student will be able to apply procedures and standards for waste management; for classification of urban and special waste, hazardous and non hazardous, solid and liquid; waste collection and transport methods. He will be able to develop the design criteria of the main methods of treatment, recovery and disposal of waste and to identify an integrated waste cycle.</p> <p>Making judgments The student will be able to evaluate the best techniques and technologies for waste management; develop a waste management plan; sizing operations for waste management in urban and industrial areas.</p> <p>Communication skills The student will acquire the ability to identify and describe the main methods for waste management, concerning waste prevention, production, transfer, collection, transport, recovery, treatment and disposal.</p> <p>Learning ability The student will acquire learning skills in the field of waste. He can participate in second level master and advanced courses on specific issues of environmental engineering, with particular reference to waste management.</p>
ASSESSMENT METHODS	<p>The exam will be oral with single test. The candidate has to answer at least three questions posed orally, on the elaborate developed during practical classes and on all topics included in the program and during the course. Final assessment aims to evaluate whether the student has knowledge and understanding of the topics, has acquired jurisdiction to interpret and independent judgment of concrete cases.</p> <p>The pass mark will be reached when the student shows knowledge and understanding of the subjects at least in general terms, and has domain expertise in order to solve concrete cases; It will also have presentation skills and argumentative as to allow the transmission of his knowledge to the examiner. Below this threshold, the examination will be insufficient. The more, however, the examinee with its argumentative and presentation skills can interact with the examiner, and the more his knowledge and application capabilities go into detail on the subject of discipline occurs, the more the assessment is positive.</p> <p>The assessment is carried out of thirty.</p> <p>Details of the valuation methods:</p> <p>Excellent - 30-30 cum laude Outcome: excellent knowledge of the topics, excellent properties of language, good analytical ability, the student is able to apply knowledge to solve problems proposed</p> <p>Very good - 26-29 Outcome: good control of the subjects, full ownership of the language, the student is able to apply knowledge to solve problems proposed</p> <p>Good - 24-25 Outcome: basic knowledge of the main topics, discrete properties of language, with limited ability to independently apply the knowledge to the solution of the proposed problems</p> <p>Satisfactory - 21-23 Outcome: the candidate does not have full command of the main teaching subjects but it has the knowledge, satisfactory property language, poor ability to independently apply the knowledge acquired</p> <p>Enough - 18-20 Outcome: minimum basic understanding of the main teaching and technical language issues, very little or no ability to independently apply the knowledge acquired</p> <p>Insufficient Outcome: the candidate does not have an acceptable knowledge of the contents of the topics covered in the teaching</p>
EDUCATIONAL OBJECTIVES	The course deals with issues concerning waste cycle, distinguishing between urban and special waste, non-hazardous and hazardous, solid and liquid waste. Topics covered in the course are directed to provide training in all phases regarding the life of the waste, with particular reference to prevention, production, transfer, collection, recycling, transport, recovery (of matter and / or

	energy), treatment, disposal. The course is aimed to complete the preparation of students who intend to carry out their professional activities in environmental engineering, with particular reference to the problems concerning the waste management, in civil and industrial applications.
TEACHING METHODS	The teaching will be organized by conducting lectures, exercises for the preparation of a project, in groups, and consequent revision of the topics, organization of technical visits.
SUGGESTED BIBLIOGRAPHY	Dispense e materiale bibliografico sono distribuiti durante il corso. Per maggiori approfondimenti, si suggerisce la consultazione dei seguenti testi: G. De Feo, S. De Gisi, M. Galasso: "Rifiuti solidi: Progettazione e gestione di impianti per il trattamento e lo smaltimento". Ed. D. Flacovio, 2012. P. Ficco: Gestire i rifiuti tra legge e tecnica. Ed. Ambiente, 2014 (free download http://freebook.edizioniambiente.it/). G. Tchobanoglous, C. Noto La Diega, P. Sirini: "Ingegneria dei rifiuti solidi". Ed. McGraw-Hill, 2009.

SYLLABUS

Hrs	Frontal teaching
5	Waste classification. European waste encoding C.E.R. Composition, sampling and analysis.
5	European and italian legislation. Procedures for waste management: the National Register of Environmental Managers; the main requirements; traceability of waste; responsibility for waste management; by-products, wastes and EOW (End of Waste); relationship between waste and discharges.
5	Waste prevention. Waste production. Methods for waste transfer and collection. Recycling. The CONAI system and the sector consortiums. Methods and facilities for waste transport. Transfer stations. Municipal collection centers.
10	Plants for waste selection and materials recovery: aerobic and anaerobic digestion of organic waste; production of compost; Secondary Solid Fuel (SSF); biostabilization and biodrying plants. Quality and possible uses of recovery products.
10	Heat treatment: incineration; types of plant; design criteria; energy recover; characterization and control of solid waste and gaseous effluents. Pyrolysis. Gasification.
10	Sanitary landfills: classification; biochemical processes; leachate; biogas. forecasting methods of leachate and biogas estimation. Technologies of landfill constructions: barrier systems at the bottom and top of landfill; leachate and biogas drainage systems. Biogas capture, treatment and recovery systems. Extraction and treatment/disposal of leachate. Management and aftercare of landfills. Capping interventions and environmental restoration. The remediation of landfills.
7	The management of particular categories of waste: WEEE, hospital waste, excavated earth and rocks, etc.
5	Special procedures for environment protection: The Integrated Environmental Authorisation (IEA), the Environmental Unified Authorization (EUA) and the Environmental Impact Assessment (EIA). The waste management plans. Implementation of procedures of LCA (Life Cycle Assessment) in waste management. The BAT (Best Available Techniques) for waste treatment and disposal.
Hrs	Practice
24	Development of a waste management plan. Sizing of some interventions for waste treatment and disposal.